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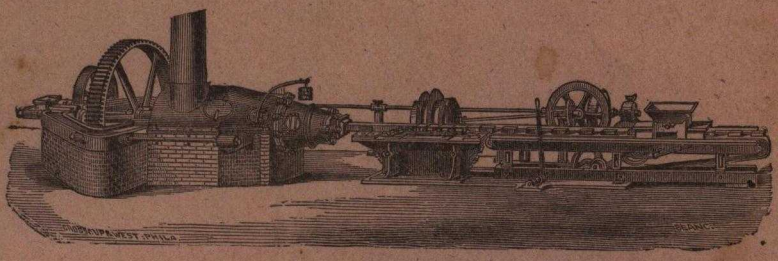
CHAMBERS, BRO. & CO.'S



NEW BRICK MACHINE.

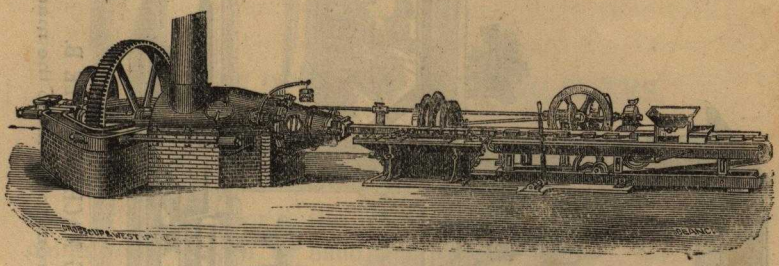
CHAMBERS, BRO. & CO.,
52d Street, below Lancaster Avenue,
PHILADELPHIA, PA.

Connected by direct wire with Edison Telephone Exchange, corner Third and Chestnut Streets.

Take Pennsylvania Railroad for Fifty-second Street, or Arch or Vine Street cars.

FIFTH EDITION.
1880.

CHAMBERS, BRO. & CO.'S



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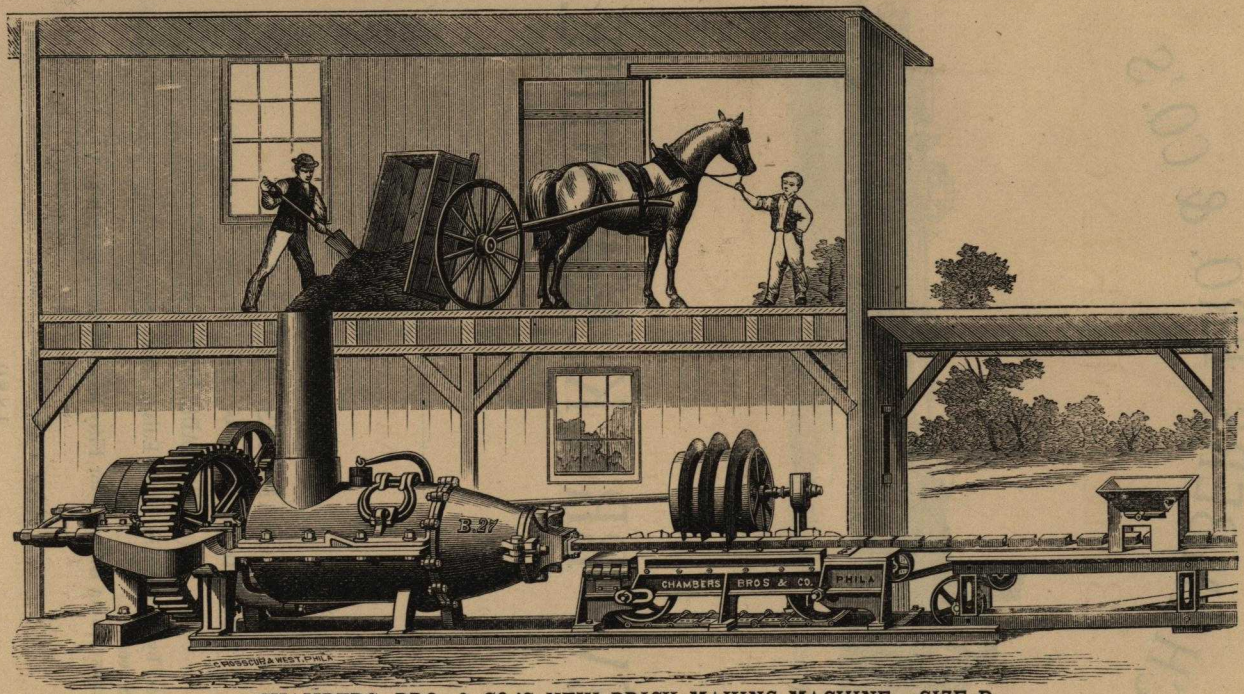


CHAMBERS, BRO. & CO.'S NEW BRICK-MAKING MACHINE.—SIZE B.

(This Cut shows the manner of feeding the clay direct from the bank to the machine.)

BRICK-MAKING.

PROCESS OF MANUFACTURING BRICKS.

THERE are manufactured annually, in the city of Philadelphia alone, over *one hundred millions* (100,000,000) of bricks, each of which, prior to the introduction of the Chambers Machine, was moulded by hand, and carried *one at a time* to the drying-floors, and there exposed to the sun—or rain, as the case might be—until sufficiently dry to be "turned up," or until spoiled by being washed by the rains; in which case they were shoveled back into the pit, to be re-tempered and made over.

After the bricks were sufficiently dried, standing on their edges, they were loaded on barrows, wheeled under sheds, and there piled in rows or "*hacked*," where the process of drying was completed, before they were ready for the kilns.

The Chambers Machine now makes about 40,000,000 annually for the Philadelphia market.

BRICK-MAKING MACHINERY.

Many efforts have been made to perform the various manipulations of brick-making by machinery, and vast sums of money have been expended in experiments that terminated in no valuable or practical results, the most common of which is known as "*the dry-clay process.*"

The reason of the almost universal failure of inventors to produce practical brick-making machines, is not because they lack mechanical skill or a knowledge of the principles of mechanics, but because they did not make themselves familiar with the materials they had to work in their machines, their action on

the machinery with which they attempted to work them, and the requirements of the manufactured article.

Many machines have been constructed to make what was apparently "*a perfect brick;*" but when it was submitted to the action of the *fire* in the process of burning, to the hardships of *transportation*, to the action of the *hammer* and *trowel*, to the *pressure in the wall*, adherence of the mortar, and to the *action of the weather*, it was found wanting in some one or all of the qualities required to stand these tests.

The bricks would either *crack* or *fall* in the burning, *break* in the transportation, refuse to *cut* at any particular point *or in* any particular direction, *crush* in the wall, or *fall to powder* by the action of the frost.

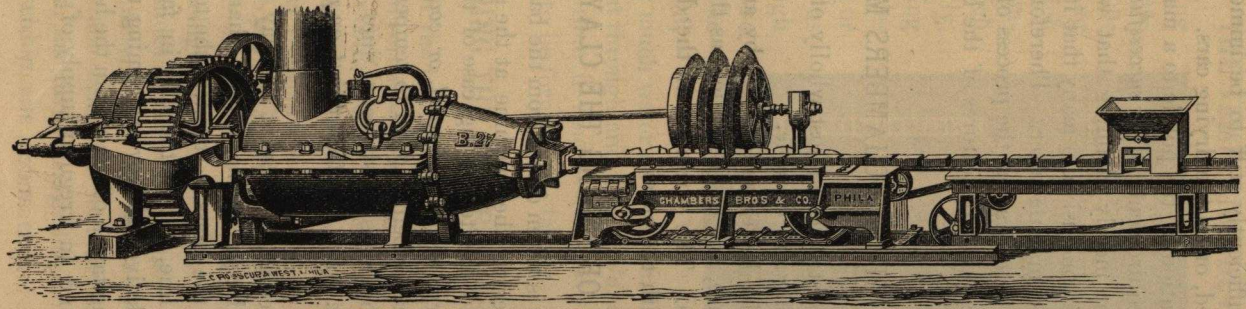
CLAY-TEMPERING MACHINES.

So far as practical results testify, that class of machines known as the "*tempered-clay machines*" have been by far the most successful, and the only process that has come into general use, or meets the approbation of the practical and the scientific brick-maker and architects.

CHAMBERS, BROTHER & CO.'S NEW BRICK MACHINE.

This machine belongs to the class known as "*tempered-clay machines,*" or "clay-tempering, brick-making machines," and was invented by Cyrus Chambers, Jr., who is well known as a mechanician and inventor.

The leading characteristics of this machine may be summed up as follows:—It mixes and tempers the clay with water as it uses it, without any additional handling, or without previously drying, rolling, or any other preparation whatever for ordinary days, taking the clay just as nature furnishes it. The machine first, after tempering the clay, forms it into a parallel bar the proper width and thickness for a brick, sands the surface, cuts this bar into uniform lengths proper for bricks, and then delivers the bricks, so moulded and sanded, at any convenient distance



CHAMBERS, BRO. & CO.'S NEW BRICK-MAKING MACHINE.

Size B.

(This cut represents the machine alone, complete.)

from the machine, sufficiently stiff to be immediately wheeled and hacked in the shed, or on the drying cars.

In calling the attention of the public to a machine for which is claimed all the requirements of a *successful* Brick-making Machine, we feel that merely claiming that we have such a machine would not be conclusive to many that it is *practical*, or of value to the brick manufacturer. Therefore, we minutely describe the machine, its operation, the process of manufacturing bricks by it, and the peculiar features of the bricks so manufactured.

DESCRIPTION OF THE CHAMBERS MACHINE.

This machine is constructed almost wholly of iron and steel, and is made very strong and durable.

We think it will be better understood by an explanation of each distinctive feature, and its operation, as the clay advances through the machine. The operation of the different features are continuous one with the other.

PLAN OF MIXING THE CLAY.

Ordinarily the clay is taken direct from the bank and dumped on the platform covering the machine at the side of a conical funnel that leads into the tempering case of the machine, and mixed, when necessary, with *loam, sand, or coal-dust;* and the requisite amount of *water* being added to temper the clay to the proper consistency, the mass is shoveled into the hopper and falls into the machine. (*See Frontispiece cut, on page 5, and Figs. 1 and 2 on page 7.*)

This hopper is circular, to prevent the clay from sticking in the corners; and is larger at the bottom than at the top, to prevent jamming of the mass. It enters the tempering case at one side of its centre line, so that the clay in falling meets the revolving tempering knives as they are coming up.

This keeps up an agitation of the clay in the hopper, and tends to prevent clogging and an irregular supply of clay to the tempering device.

THE TEMPERING DEVICE.

The tempering portion of the machine (Fig. 1) consists of a strong iron case, in which revolves a horizontal shaft, into which are set, spirally, strong tempering knives, or blades of wrought iron or steel, so that, as they pass through the clay, they move it forward. The clay being stiff, and not having much water on it, is not liable to *slip* before the knives, but is cut through and through, and *thoroughly* tempered, so that by the time it reaches the small end of the tempering case it is ready to be formed into bricks.

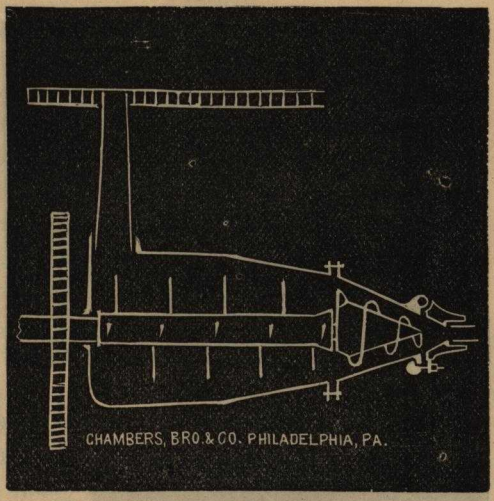


FIG. 1.

FORMING THE SQUARE BAR OF CLAY.

On the end of the tempering shaft is secured a conical screw, which revolves in a chilled-iron conical case, the inside of which is ribbed, lengthwise, so as to prevent the clay from revolving in it, and is chilled, to prevent wearing. (*See Fig. 1.*)

The screw being *smooth* and very hard, the clay slides on the screw, thus becoming, as it were, a *nut;* the screw revolving, and not being allowed to move backward, the clay *must* go forward, sliding within the screw case.

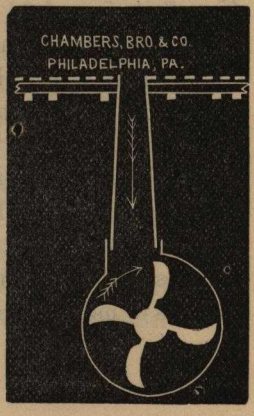


FIG. 2.

This case is heated by steam, which greatly facilitates the sliding of the clay, and saves considerable power.

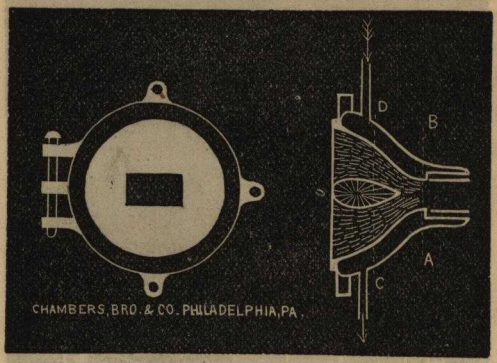


FIG 3. FIG. 4.

This operation further tempers the clay, and delivers it, in a solid round column, to the *forming die*, which is of peculiar construction and form, and so designed as to reduce the round column to a rectangular one, whose breadth and thickness is the *proper breadth* and *thickness* for a brick, while at the same time it *forces the clay into the corners* of the square or rectangular finishing part of the die, so that the angles of the bar of clay are made very solid and sharp, thus insuring perfectly square and well-defined corners to the bricks. (*See Figs. 3, 4, 5, and 6.*)

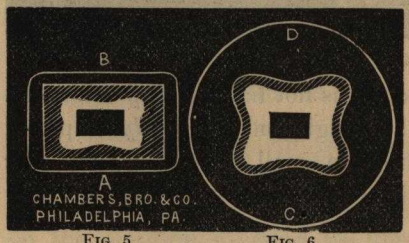


FIG. 5. FIG. 6.

The Former is secured to the screw case by a hinge and swing-bolt, so that it may be quickly swung open for the removal of stones. It is also heated by steam, to facilitate the forming and sliding of the clay.

The forming and finishing part of the die (which determines the exact breadth and thickness of the bar of clay or the brick) is hard iron lining, that can be removed and renewed in a few minutes and at a trifling cost, thus enabling us to always keep our dies or moulds, and consequently the bricks, to standard size.

THE NEW CUT-OFF.

This is *the* great improvement recently made in the Chambers machine as heretofore introduced, and is believed to be the perfection of this heretofore almost perfect machine. It is the result of sixteen years' study and experimenting, at a cost of many thousands of dollars. This cut-off consists of a thin blade of steel, secured to the periphery of a drum, in the form of a spiral, the distance between the blades of which is that required for the length of a brick, and the projection of which gradually increases from nothing at its first end to the full width of the widest brick to be cut.

This spiral knife runs perpendicularly in openings in the links of an endless chain, supported upon rollers, the chain being so formed as to support the bar of clay from the bottom and one edge; so that the spiral blade, in passing through the clay, is fully supported, while being slowly cut off with a long drawing cut.

The distance between the spiral blades being uniform, the lengths of the brick are absolutely uniform, thus overcoming one of the greatest practical objections hitherto existing in the Chambers machine.

The drawing cut of the spiral blade cuts the ends of the bricks perfectly smooth, thus correcting another defect hitherto existing in these machines.

The speed of this spiral-cutting blade is controlled by the clay itself; hence, no matter how irregular the flow of clay from the die, the spiral runs in exact unison therewith; consequently, the absolute uniformity in the length of the bricks.

This controlling of the speed of the spiral by the clay is so positive, that it will run at any speed, from three to sixty bricks per minute, while the machine runs at its regular speed.

These cutting and regulating features are the new parts, and overcome objections heretofore urged against Chambers' old machine.

OFF-BEARING AND SANDING.

The bricks, thus cut from the continuous bar, are separated and carried by an endless belt any desired distance,—sometimes two hundred feet across the yard,—from which the bricks may be wheeled to any point most convenient for "hacking." As the bar of clay issues from the forming die, it passes through a small chamber filled with fine, dry sand, which adheres to the surface of the bricks, renders them much nicer to handle, prevents them from sticking together on the barrows or in the hacks, or on the *drying cars*, and much improves them in color when burnt.

By its use a sanded surface is produced, which closely resembles that of a hand-moulded brick, and renders them less liable to "daub" in laying. This sanding device is a recent invention of our foreman, William Mendham, and accomplishes in a very simple manner a very desirable object.

PROVISION FOR STONES.

All clay has more or less stones in it, and as it is impracticable to pick them *all* out, and requires considerable power and machinery to crush or screen them, there is a necessity of making some provision for them even if there should be only *one stone* in every "ten thousand of clay."

The tempering knives run six inches from the case, in the new machine (Size B), so that there is no danger of a stone five inches in diameter catching between the end of the tempering knives and the case, but they are frequently imbedded in the clay that occupies the space between the ends of the knives and the case. If a stone is more than three inches in diameter, and does not lodge in the stationary lining of clay in the case, it will lodge at the entrance of the screw, preventing the clay from issuing at the die, when a hand hole is opened, through which the stone may readily be removed. If a stone less than three inches in diameter passes to that point, it will go through the screw, the openings between the threads being *less* at the entrance than at any other point; so that a stone that once fairly enters can not lodge until it has reached the forming die, where it will lodge if

it is *larger than a brick is thick*, and prevent the proper flow of clay, causing the bar to split in two, or only part of the bar to issue; this forming die being secured on hinges, in less than one minute it can be swung open and the stone knocked out, when the die is closed and the machine again started. It is not very often that, in working good brick-clays, stones larger than a brick is thick get into the machine, and very seldom that one larger than the opening to the screw; so that we are seldom troubled with stones that will not pass the screw, it having occurrred only a few times, to our knowledge, in the many machines we now have running.

Small stones occur much more frequently, and pass freely through the machine, being buried in the bar of clay and passing to the "cut-off." When a stone should happen to be buried in the bar of clay at the line of severance, the spiral knife must either cut through the stone, be broken, or some provision made by which it shall not be injured. The first is not practicable, as the stones are often very hard; and to break a knife every time it should happen to strike a stone would render the machine useless.

In order that the spiral knife should not be affected by stones, the drum to which it is secured is held in position by gravity, which holds it with *just sufficient force to compel the knife to pass through the bar of clay*. When the knife comes in contact with any hard foreign substance, as stones, brickbats, or bones, the drum yields, and allows the knife to move up, and thus cuts to it, the knife immediately returning to its original position, and cutting through the bar again.

These spiral blades are made of steel, and will cut off, in good smooth clays, from two to three millions of bricks, and in stony clays, from one to two millions of bricks. These blades are secured to the drum by a spiral clamp, and can be replaced in a few moments.

THE RESULT OF OUR EIGHTEEN YEARS' EXPERIENCE.

Our long experience in working machinery in clay, and the great varieties of clay we have worked, coupled with our thorough

and practical knowledge of machinery, its construction and operation, has enabled us to construct a machine adapted to the art of brick-making, which at once impresses the practical man with favor. This machine has no moulds, in the usual sense of the word, no plungers, no cams, no toggles, but all of its movements are rotary and continuous.

All the main moving parts have their journals in one solid casting.

The whole machine is self-contained,—that is, all complete within itself. It can not settle out of line; all wearing parts are easily renewed.

Each casting has a letter and number cast upon it, indicating the size of the machine and the particular piece.

They are all fitted to standard gauges, so that by sending the letter and number, any piece can be duplicated at once, and fit guaranteed.

This machine is replete with the little conveniences and requirements for its easy care and durability.

Each oil-cup has a self-closing lid, so that it can not carelessly be left open.

Each journal has a dirt-band over it, to prevent the dirt from working into it, and many of them are entirely closed at one end for protection.

We have spared no pains or expense to develop this most beautiful machine.

Beautiful in operation, in design, in the mechanical contrivances adapted to the end in view, and we think decidedly the most practicable, complete brick-making machine ever offered to the public.

It is our "masterpiece," and its success is such that we unhesitatingly make the following offer to

SELL, SUBJECT TO TRIAL AND APPROVAL:

For any responsible brick-maker in the United States, located where we have not already sold exclusive rights, or those already owning the right for the old machine, and having suit-

able clay and power, we will set up our machine subject to thirty days' trial and approval, and if not satistactory in every respect, after said trial, will remove same free of cost to the parties.

WARRANTEE.

Many persons who use our machines say we do not claim enough for them, that "People are not expected to believe all that is claimed for new machines;" but *we warrant our machines to be as represented, and to do all that is herein claimed for them.* Of all the machines we have running, not one has failed to do what we claimed for it; many of them do more.

SIZES AND STYLES OF MACHINES.

All brick machines introduced by us prior to the year 1878, have been of one size, designed to make from twenty-five to forty thousand bricks in ten hours. Finding a demand for a smaller and less expensive machine, that will make from fifteen to thirty thousand bricks per ten hours, we are now manufacturing such smaller machine. The two sizes are known as Sizes A and B, their distinctive features being as follows:

MACHINE, SIZE A.

This machine is identical with those introduced by us since 1862, except the improvements which have been invented and introduced within the past few years.

These improvements consist in the "conical hopper," improved "tempering shaft," "fluted screw case," and the "improved form of screw," by which better bricks and more of them are made, with less power and less wear and tear.

The improved "*former die*" and the new dusting machine will be put on all new machines of this class, and may be attached to all that are now out, but the new "spiral cut-off" (hereinbefore described) will not be attached to the new machines

of this size. This machine, notwithstanding the objections hereinbefore pointed out, is a very rapid, practicable, reliable brick-making machine, suitable for manufacturing large quantities of rough brick, guaranteed to produce from twenty-five to forty thousand bricks, from proper material, in ten hours, but it is being superseded by

THE NEW MACHINE, SIZE B.

This machine is newly designed, combining in one "self-contained" machine all the improvements pointed out by sixteen years' practical use, in a great variety of clays.

Although the size of this machine is not so great as that of Size A, its capacity is proportionately greater and it is much stronger; all parts being heavier, wearing surfaces enlarged, and all the working parts of the machine built on an iron frame, so as to be set up without requiring independent foundations.

It is designed for severe service, and the economical production of from fifteen to thirty thousand bricks in ten hours, which we guarantee.

PRICES OF MACHINES.

The price of our old style brick machine complete, Size A, with thirty-two feet of off-bearing belt, sanding machine, driving pulley, and foundation bolts, free on board in Philadelphia, has been materially reduced. The price now is two thousand dollars ($2000).

The price of the new machine, Size B, complete, free on board or set up in Philadelphia, is two thousand dollars ($2000). In all cases these prices are exclusive of the right to use, and subject to any material advance in iron.

PATENTS.

Our brick-making machine is protected by twelve separate and distinct patents of the United States.

These patents were all granted under the new law, and cover a term of seventeen years from their respective dates.

Patents in some foreign countries are granted, and others in course of preparation.

VALIDITY OF THESE PATENTS.

The validity of these patents has never been questioned. *The inventions are so novel, that not a single patent had ever been granted by the United States Patent Office before these* for this class of brick-making machines. The following letter from our patent solicitor and attorney, will show the probable validity of the earliest of these patents:—

No. 1609 Chestnut Street, Philadelphia,
January 21st, 1865.

"Dear Sirs:—Before making application for your brick-machine patents, I made an elaborate and minute preliminary examination of the state of the art of brick-making, both in this country and in Europe. The result of that examination, added to considerable previous knowledge of the subject, was a decided conviction that you had made an invention which embraced many features entirely novel, and equally essential to the practical success of machines operating on the principle of 'expression.' Your patents were granted, after careful examination by the Patent Office, *without a word of alteration, and* I have no doubt of their validity, and their comprehensive and controlling character.

"Yours, truly,

"Chas. F. Stansbury.

"Messrs. Chambers, Bro. & Co.,
"Philadelphia."

RIGHTS AND PRIVILEGES.

Where we have sold exclusive territorial rights under the old or earlier patents, we can not *now* give right to use this new machine, without first arranging with the parties owning said territory. Neither can they in any case convey the right to use this new machine.

When we assign the full right to use this improved machine (Size B) in a territory not wholly belonging to us, we arrange for the same with the owner of said territory, and give good and sufficient title for the use of the same.

We sell "*single machine*," "*yard*," "*County*," or "*State rights*," for the vending and using of these machines, *reserving the right*

to manufacture the machine ourselves, and in no case does the purchase of a machine alone convey the right to use it. One object is to give those purchasing the exclusive privilege of manufacturing bricks by our process, within certain territorial limits, in consideration of the amount paid. We reserve for ourselves the exclusive manufacture of the machines in the United States.

Our whole interests in the invention in foreign countries will be disposed of.

DRYING BRICKS.

The bricks, direct from these machines, are ready to be off-borne and put *immediately into the "hacks" under the sheds, without sun-drying.*

The off-bearing belt may be extended along the whole length of the yard at the head of the shedding; so the longest "wheel" will be the length of the shedding; or the machine may stand the other way, and the longest wheel be from the centre of the shedding, where the "off-bearing belt" runs, to the outside shed.

From six to fifteen days are required to dry the bricks sufficiently for the kilns under the shedding, Philadelphia climate, and from eight to ten hours in the dryer. (See Dryer, page 29.)

QUANTITY OF BRICKS THE CHAMBERS MACHINES WILL MAKE.

Machine Size A is guaranteed to produce from twenty-five to forty-five thousand bricks (Philadelphia size) in ten hours.

Machine Size B from twenty to thirty-five thousand.

QUALITY OF BRICKS MADE BY THE CHAMBERS MACHINES.

The quality of the bricks manufactured by our machines as compared with hand-made, or those made by other machines, is superior, we think, in many respects and for many purposes. This opinion is based upon the following facts:—

1st. The clay is more thoroughly tempered, and the different strata of clay, sand, and loam are more thoroughly mixed

through each other, than in any other machine that we are familiar with.

2d. The particles or granules of the material of which bricks are usually composed, especially when poor clays are used, vary very much in size. While the bar is being moulded or formed, these particles of various sizes being all in *motion while under pressure*, the small ones arrange themselves between the large ones, thus filling up the interstices, the finer particles working to the surface; so that a bar formed of comparatively *rough clay* will present a *fine* grained surface. Thus we are enabled to get a compact brick, with a good, smooth surface, from an indifferent clay.

3d. As the clay is tempered it is gradually compressed, thus making a solid, homogeneous bar, from which bricks are cut.

4th. They are very much stronger than hand-made bricks. A hard brick made by this process will sustain a pressure of sixty tons, and a "salmon" or "pale" brick about fifteen tons. (See Table, page 25.)

5th. They absorb very much less water. (See Table, page 27.)

6th. They will save in building about ten per cent. in wastage (See Certificates.)

COST OF MANUFACTURING BRICKS BY CHAMBERS' PROCESS.

The labor required to run one of Chambers' machines Size B (exclusive of digging the clay, hauling it to the machine, and off-bearing the bricks) is, one man to feed the machine, one engineer to run the engine, and one boy to sift the sand, and attend to the sanding device.

Two-thirds of a ton of anthracite coal, or of anthracite coal-dust, eighteen bushels of bituminous coal, or one cord of wood with a good engine will make twenty-five thousand bricks from good clay. From this the cost of converting the clay into green bricks, can easily be computed for any locality.

The labor and materials usually required to produce from thirty to thirty-five thousand bricks per day of ten hours are as follows:—

From four to six men to dig and load the clay at the bank,

one boy to drive the carts, three horses and carts, one man to feed the machine, one engineer, one boy at sand machine, two off-bearers (boys), two wheelers, two hackers, one ton of coal, one quart of oil; which produce on an average thirty thousand bricks, *hacked under the sheds.* These figures will vary slightly in different localities, and clays, but may be relied upon as a fair average.

COST OF MAKING BRICKS BY THE OLD PATTERN CHAMBERS MACHINE, IN 1877.

4 Bank men @ $1.50,	$6 00
2 Horses @ $1.00,	2 00
1 Driver,	50
1 Hopper feeder,	1 60
1 Engineer,	1 75
2 Wheelers from belt @ $1.50,	3 00
2 Hackers @ $1.50,	3 00
2 Off-bearers, 75 cents,	1 50
1 Ton pea coal,	2 80
Oil,	20
Cost per day	$22 35

Making 27,500 bricks, on an average, per day, costing in the sheds 81 cents per 1000, exclusive of interest on investment and wear and tear, &c.

COST BY HAND IN 1877, AT SAME TIME AND PLACE.

2 Clay loaders @ $1.00,	$2 00
1 Carter,	50
1 Clay temperer,	1 00
3 Horses,	3 00
Cost for filling pits and tempering, per day for 6 gangs,	$6 50
For filling pits and tempering, per gang, per day,	$1 08⅓
1 Moulder (average per day),	2 00
1 Off-bearer,	1 00
1 Wheeler,	1 50
Cost, per day, for each gang making 2500 bricks,	$5 58
Making cost per 1000 bricks,	2 25
Digging clay (in winter),	25
Cost of bricks per 1000, in sheds,	$2 50

COST OF BRICKS IN SHEDS, UNBURNED, IN 1877.

By hand, per 1000,	$2 50
" Chambers machine, Size A,	81
Difference in favor of machine, per 1000,	1 69

With the pattern, Size B, we can save from one-half to one-third of the fuel used, and produce much better and more salable bricks.

This would further reduce the cost of machine-made bricks about five cents per thousand, and leave a saving in favor of the B machine, over hand-made, of $1.74 per thousand.

THE COUNTER FOR PIECEWORK.

The labor for operating our machine is often given out by the thousand, in which case every employé becomes interested in producing the best results. When this is the case, the machine is usually supplied with an automatic counter, which counts the number of bricks made, and indicates in tens, hundreds, thousands, tens of thousands, and millions.

The first four dials are open for the operatives, from the records of which they are paid; the million dial being under lock and key for the proprietor's private inspection, and by which he is enabled to check any irregularities in count, &c. The cost of the counter is $50 extra.

BURNING.

The cost of burning bricks made by our machines, and dried in the sheds in the usual way, is, so far as we have been able to ascertain, about the same as that of other bricks, if anything less, and varies so much with the nature of the clay, the kind of fuel used, and the kinds of kilns or clamps, that we can not give any data by which the cost of burning could be ascertained to a certainty in various localities.

The most successful and economical burners in this vicinity now use coal. Anthracite, bituminous, and semi-bituminous, each have their advocates; and, so far as we know, any kind of fuel, properly managed, will burn bricks.

It requires from one-fourth to one-half of a cord of wood to burn one thousand bricks, depending on the quality of the wood and the kind of kiln and clay. It requires in Philadelphia, with our ordinary coal kilns, from three hundred and fifty pounds to four hundred pounds of coal to burn one thousand bricks, or from twenty-five to thirty-five tons of coal to burn two hundred thousand bricks. It takes from three to six days and nights to burn a kiln of red bricks, and requires two men—one burner and one assistant—when coal is used. Kilns in which it is designed to burn coal must be prepared expressly for it. From this data the cost of burning in any location may be approximated, bearing in mind that these figures refer to bricks of Philadelphia sizes, and kilns with improved doors and grates.

KILN CASTING.

The most practicable kilns, as used in Philadelphia, are all fitted with iron grates, doors, &c. These we manufacture of the most improved proportions and designs, at low prices.

Estimates for kiln castings furnished upon application, and drawings of the most improved Philadelphia coal-burning kilns will be furnished to those purchasing kiln castings from us, without additional cost.

COST OF DIFFERENT SIZES AND KINDS OF BRICK.

The size of the bricks will make a material difference in their cost. For instance, the size of common bricks in the New England States, and some others, is much smaller than those made at Philadelphia, from which the above data was taken, which leaves a large percentage in favor of the smaller bricks made by our machine.

A Philadelphia brick contains about 85.6 cubic inches of clay. A Boston or a Hudson river brick contains about 69.12 cubic inches. Therefore, twenty-five thousand (25,000) Philadelphia bricks make thirty thousand nine hundred and thirty-two (30,932) of the Eastern bricks; hence the cost of making them is almost, in proportion to their size, say twenty per cent. less.

In some parts of Europe and South America bricks are made much larger than in Philadelphia; consequently the cost is proportionately greater, and the rapidity of their manufacture by our machine proportionately less than the above figures. We construct our machines to make whatever size bricks is used in the locality for which it is wanted; and if it is desired to change the size of the bricks after the machine is completed, it is easily done by changing the size of the die for variation in breadth and thickness, and the pitch of the spiral knife and length of the chain-links for the length of the bricks.

FIRE-BRICKS.

The adaptation of our machine to the manufacturing of fire-bricks is most admirable, we think. We have manufactured a few thousand by it for the express purpose of testing the machine and the quality of the bricks so made. The fire-clay works better in it than the *best* common brick-clay. We have tried quite a variety of fire-clays and mixtures for making fire-bricks on our machine, and they all worked well notwithstanding much of the "*biscuit*," "*cement*," or *silex* was one-quarter to three-eighths of an inch in diameter. We claim that our machine will make better fire-bricks than can be made by any other process, because the materials of which fire-bricks are usually composed vary very much in size; this variation being from an impalpable plastic mass to lumps of cement, biscuit, or silex, three-eighths of an inch in diameter. During the process of tempering and moulding, this conglomerate mass is kept *constantly in motion while under pressure;* consequently, the *smaller particles arrange themselves in the interstices between the larger ones*, and the finer particles between them again, and so on, until every crevice is filled and the air excluded; the result of which is to make a *dense* and *homogeneous* brick,—a result which can not be obtained by *any amount of direct pressure* without this motion of the particles.

It is the opinion of chemists and others that fire-bricks so manufactured would stand (in uniform, intense heats) much longer than ordinary fire-bricks.

Bricks designed for sudden variations of temperature should be as porous as possible, and may be made by our machine, also, by mixing *saw-dust*, *coal-dust*, or any other combustible matter with the clay.

The Cambria Iron Company, at Johnstown, Pa., make the covering tile used for the runners at their Bessemer Steel Works, by our machine.

MANUFACTURE OF PRESS BRICKS.

A fair quality of "*press*," "*fronts*," or "*face*" bricks are made by *re-pressing* the bricks, as they come from our machine, in an ordinary hand-press. Bricks made by this process are free from what are known as "*sand cracks*," but more liable to crack from drying and burning.

To manufacture press bricks by our machine, we put on a die that will mould the bricks sufficiently *narrow* to drop into the mould of the press, and *thick* enough to make a press brick of the proper size. This can be done in five minutes. These bricks are taken from the machine in the usual manner, and wheeled to the "*press shed*," where they are "*hacked*" close; that is, so as to prevent the air from passing between them, thereby keeping them at about the same consistency as when they were made, which is just right for re-pressing. From this close hack the bricks are taken, and re-pressed in the usual manner; or, if a sufficient number of presses be used, or the machine run slow, the bricks may be taken and pressed direct from the machine.

This re-pressing brings the bricks to almost a mathematical precision as regards the surfaces and angles,—the flat or largest surface of the brick being *concave*, for the purpose of allowing the edges to come close, so as to show a very thin joint when laid.

Sometimes, when a very nice brick is desired, they are rubbed in fine sand and then re-pressed. We do not think the "skin" on the bricks moulded in our machines so good as those moulded in sand by the usual process; but where the clay gives the "color" and not the moulding sand, then the best color is

obtained by re-pressing our machine bricks direct from the machine, made without sand.

BRICK PRESSES.

We sell brick presses or machines for re-pressing bricks. This is a small machine on wheels for re-pressing bricks, made either by hand or by our machine. It is portable, and is moved along the hacks as the bricks are re-pressed. They are made with single or double levers, as may be ordered.

Price, from $115 to $150, according to size and style.

SELECTING CLAYS.

Too much care can not be taken in selecting clay.

It is the most important thing in starting the manufacture of bricks. If you have not good materials, it will be impossible to make the best quality of bricks, either by hand or machinery.

Our machine will, so far as we know from the great number of machines we now have running in various localities, and from experiments made with clays from almost every country, work any clay that bricks can be made of by hand, and *we do work*, successfully, some that is pronounced by judges *unfit* for the hand process.

Our machine works easiest in plastic or strong clay, and makes the best bricks from loamy clay; but any clay that will make good bricks by hand may be used with success in our machine, *except those clays of a quicksand nature*, that hold so much water that when it is put into the machine and tempered it is so soft that the bricks moulded from it will not bear handling, and are not stiff enough to hack.*

To dry the clay in bulk is *not* practicable, except at a great expense. Hence the impracticability of "dry clay machines."

Our machine will make better bricks of *weak clay* than can be made from it by hand. *Pure sand can not be worked in our machine.* Strong or argillaceous *loam* may be used alone for making bricks, but more plastic material can be worked more economically.

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* One machine has been unsuccessful from this cause.

Stony clay should be avoided when possible; also, clays of a quicksand nature.

It is desirable to have a large body of clay together, so that in a few years' operations you will not be compelled to bring clay a great distance, or move your machinery.

Where the clay bank can be drained without pumping, it is much preferable, and more economical.

The foregoing will enable any one of ordinary skill and judgment in the art to select such clays as will be suitable for manufacturing bricks by our machinery, but in all cases we recommend a test.

TO PARTIES WISHING CLAY TESTED.

We have a model of our brick machine, which was constructed for the express purpose of illustrating it, and testing the practicability of working various clays on it.

This model is one-fourth size, and was originally built from the same drawing as the large one, size A, and has all the improvements on it that had been made up to the time of its construction.

Any one who wishes any specimens of clay, or other plastic material, tried on our model machine, can have it done by paying all the actual expenses attending it, which are trifling. We make no charge for the use of the machine, or our attention.

About one-half barrel of material should be sent for each test of this kind. When desired, we will appropriately stamp and burn these small bricks, and return them, so that any one can judge of the quality of the article their clay will make when manufactured by our process.

STRENGTH OF BRICKS.

The test of the strength of bricks manufactured on our machine, and other machine-made and hand-made bricks, has not been as varied and extensive as we should like.

The following experiments were made at Messrs. Whitney & Son's Car-wheel Works in their hydraulic press for forcing on car wheels.

We were surprised to learn that the press was not of sufficient strength and power to crush our best machine-made bricks, although we forced it to about ten tons pressure more than the machine was designed to stand.

TABLE OF PRESSURE UNDER WHICH BRICKS CRUSH.

Number.	Degree of Burning.	Locality of Clay.	Process of Manufacture.	Position.	The Material between which the Bricks were placed.	Number of Pounds to the Square Inch at which Bricks Crushed.	Number of Pounds and Tons Pressure at which Whole Bricks Crushed.
		Pea Shore, N. J.	C. B. & Co. Machine.	End Pressure.	Ash wood.	Pounds.	Pounds and Tons.
1	Salmon.	"	"	"	"	1,120	8,960 = 4 tons.
2	"	"	"	Edge.	"	980	15,680 = 7 tons.
3	"	"	"	Side.	"	1,260	40,320 = 18 tons.
4	Light Stretcher.	"	"	Edge.	"	840	13,440 = 6 tons.
5	Hard.	"	"	Side.	Cast Iron.	4,200	134,400 = 60 tons, without crushing.
6	Salmon.	Philada. Neck.	By hand.	Edge.	"	700	11,200 = 5 tons.
7	Light Stretcher.	"	"	Side.	"	1,050	33,600 = 15 tons.
8	Hard.	"	"	"	"	2,100	67,200 = 30 tons.

The first four experiments were made with the bricks laid between ash planks, but the wood crushed and spread out, carrying the edges of the bricks with it, so that we consider the pressure at which they crushed very far below the actual pressure the bricks are capable of sustaining, although it proves that they will bear much more than a piece of hard wood. The last four experiments were made with the bricks between

plates of cast iron, *without any cement*, or anything between them, the rough, uneven surfaces coming in contact; consequently, they were much more severe than though the bricks had been laid in cement, so as to allow the pressure to be evenly distributed over the whole surface.

On reference to the table, test No. 5, it will be observed that a brick made from Pea Shore clay, by the Chambers machine, size A, and burnt hard, *would not crush* under a pressure of one hundred and thirty-four thousand four hundred pounds, or a pressure of *four thousand two hundred pounds* to the square inch, while a hand-made brick (No. 8), made from Philadelphia Neck clay, and burnt to the same degree, *crushed* at sixty-seven thousand two hundred pounds, or under a pressure of *two thousand one hundred pounds* to the square inch, or at one-half that under which the Chambers' machine-made brick would not crush.

The hydraulic press registered the weight to one hundred and thirty-four thousand four hundred pounds. We judge from the movement of the indicator that a pressure of one hundred and fifty-six thousand eight hundred pounds was given, showing that bricks made by our machine will sustain *one hundred and thirty-three per cent. more pressure* than hand-made bricks.

There can not certainly be any question about the strength of bricks that will stand such enormous pressures.

Where our hand-made bricks are used for culverts, they are "dumped" from the cart into the ditch without injury, whilst the hand-made bricks used for the same purpose had to be tossed to prevent breaking.

AMOUNT OF WATER BRICKS ABSORB.

In order that we might ascertain the compactness of our bricks as compared with hand and other machine-made bricks, we submerged the following-described bricks in water, keeping them there *thirteen days*, having previously marked them with numbers and carefully weighed them. After submerging they were again weighed, and the number of ounces of water absorbed by each carefully noted.

The following table shows the result of the experiments:

WATER ABSORBED BY VARIOUS BRICKS.

No.	Degree of Burning.	Locality of Clay.	The Process of Manufacture.	Weight in lbs. and ozs. before Submersion.		Weight in lbs. and ozs. after Submersion.		Gain in Weight in Ounces.	Percentage of whole Weight Gained.	Remarks.
				lbs.	oz.	lbs.	oz.	oz.		
1	Hard.	Pea Shore, N. J.	Chambers' Machine.	5		5	2	2	2.5	
2	Dark.	"	"	4	15	5	7	8	10.12	
3	Light.	"	"	4	14	5	10	12	15.4	
4	Salmon.	"	"	"		5	12	14	17.95	
5	Very Hard.	"	Hyd. Press, 600 tons pressure.	2	4	2	6	2	*5.55	*This brick, in the process of manufacture, was submitted to a pressure under a hydraulic press of 121,695 pounds to the square inch.
6	Dark.	"	Dry Press.	4	13	5	7	10	13.	
7	Salmon.	"	"†	2	8	3	1	9	22.5	†This brick was made, by the *dry-clay* process, of the same clay as No. 1, and was exposed one winter to the action of the frost, and had partially fallen, none of the angles being left.
8	Dark.	Hestonville, Phila.	Chambers' Machine.	5	3	5	15	12	14.46	
9	Dark.	"	"	5	5	6	3	14	16.47	
10	Light.	"	"	5	3	6		13	15.66	
11	Salmon.	"	"	5	8	6	8	16	18.18	
12	"	"	Hand.	4	8	5	8	"	22.22	
13	Light.	"	"	4	10	"		14	18.91	
14	Hard.	"	"	4	12	"		12	15.78	
15	Salmon.	Neck, Phila.	"	4	8	5	7	15	20.83	
16	Light.	"	"	4	13	5	9	12	15.58	
17	Hard.	"	"	4	11	5	2	7	9.33	
18	"	"	"	4	10	5	3	9	12 16	
19	Dark.	Hudson R., N. Y.	Hall's Machine.	4	3	4	6	3	4.47	
20	Light.	"	"	4	2	4	12	10	15.15	

It will be observed, by reference to the above table, that a hard brick (No. 1), made by our machine, absorbs only *two and one-half per cent.* of its weight in water, while a dark brick (No. 6), made by the *dry-clay process*, from the same clay, absorbs *thirteen per cent.* of its weight.

The salmon brick (No. 7), made by the dry-clay process, absorbed *twenty-two and one-half per cent.*

A salmon brick (No. 11), made by our machine, absorbs eighteen per cent., while a hand-made (No. 12), made from the same deposit of clay, absorbs twenty-two per cent.

A round brick (No. 5), which was made of *dry-clay* from the same place as No. 1, with a pressure in a hydraulic press of six hundred tons on the whole area, which is equivalent to one hundred and twenty-one thousand six hundred and twenty-five (121,625) pounds to the *square inch*, and burnt very hard (vitrified), absorbed five and a half per cent.

This demonstrates how impracticable it is to make solid bricks without tempering the clay, no matter how much pressure is applied or how hard they may be burnt.

For those interested in the quality and texture of bricks, this table shows many interesting facts relative to the qualities of the various bricks; for example, the amount of the water absorbed by each of the various classes of bricks is about in the proportion to the degree of burning. The average percentage of absorption by our machine-made bricks is much less than by the best hand-made bricks, and a great deal less than those made by the *dry-clay* process.

CHAMBERS, BRO. & CO.'S ARTIFICIAL BRICK DRYER.

The Dryer consists of six or eight brick flues, about forty feet long, three and a half feet wide at bottom, and two feet at top, and four feet high, built of bricks, with a railroad-track through each, slightly descending from the machine, with fire-grates and doors at lower end, and stack at the upper end.

Each flue has an iron door, sliding in iron grooves and counterpoised by a weight at either end, so that the flue is readily opened and closed for the admission and exit of the cars.

CARS.

The cars are made of iron, and are designed for the convenient loading and unloading of the bricks, and run *without lubrication.*

They run so lightly that a *boy* will transport four hundred and forty (440) bricks on one of them with *greater ease* than a *man* will fifty bricks on the best-designed barrow. At each end of the flues is a transfer or switching-car, which transfers the loaded cars from a single track, running from the machine, on to any one of the six running into the flues; and in like manner from any one of the six flues to the track running to the kilns.

The loaded cars are turned into any one of the kilns by means of small turn-tables, and the empty ones returned to the machine by a return-track, outside of the flues.

The whole of this arrangement is under an inclosed building, and quite comfortable to work in at all seasons.

OPERATION OF THE DRYER.

The cars are moved to the side of the machine, where the bricks are hacked on them direct from the off-bearing apron, and require *no more handling* until ready to "*toss*" in the kiln. One man will hack 30,000 bricks upon these cars, ready for drying, direct from the machine, in ten hours.

The loaded car is then run on to the transfer car, and from thence into any one of the flues, where a current of heated air (an *artificial* summer breeze) is forced through them,—the steam from the bricks near the fire condensing on the surfaces of the cold ones, and preventing checking or cracking, while the bricks absorb the heat from the steam, and *commence drying from the inside first.*

When the bricks directly over the fire are dry, the car is run out to the kiln to be set, a fresh car being put in at the upper end, pushing the others down, and bringing another partially dry car immediately over the fire, and so on.

One ton of anthracite coal will dry twenty-five thousand bricks, but as the Dryer saves the most of this coal in the burning of the bricks (as we are now advised), and saves handling the

bricks twice,—once in hacking or laying on the floors, and once in reloading on to barrows, to be wheeled to the kilns; also dispensing with two or three wheelers from the machine to the sheds, and one of the wheelers and one loader in the setting-gang, the cars running direct from the machine into the tunnel, thence into the kilns, the bricks being set from the cars, one of the setting-gang tossing and one managing the cars alternately,—the *expense* of the coal for *artificial drying* is *less* than the use of *sunshine.*

The advantage of running an establishment in all weathers, and twelve months in the year, instead of eight, and having bricks in the spring, when they command the *best price,* is too evident to need argument, to say nothing of the advantage to be gained in giving employment to your workmen the whole year round, and the difference in the cost of labor between winter and summer; but all of these advantages sink into insignificance when the superior quality of the bricks is considered. The bricks not being disturbed from the time they are put on the cars until they are run into the kilns, they avoid the two handlings in loading on the barrows and the two wheelings, whereby their shape and angles are preserved, rendering them much more perfect when burnt, and increasing their value in the market, while their cost is less than shed-dried bricks.

We have taken the clay from the bank, *mixed it with water, tempered, moulded, dried,* and *set* in the kiln, in the form of good, square, solid bricks, in *eight* hours.

Our Dryer is not practicable in very strong clays or clays that will not dry without cracking in the sun, but for loamy or sandy clays that do not easily crack in drying, we can recommend it as economical and profitable.

ADVANTAGES GAINED BY THE USE OF CHAMBERS' MACHINE AND DRYER.

Our machine, receiving the materials properly mixed, that is, the different strata of clay, sand, and loam, for making bricks, direct from the bank, and converting it into bricks, without any additional handling, ready to be immediately *hacked* on the

drying cars, saves a great deal of labor in "*tempering the clay*," "*wheeling*" to the floors, "*moulding*," *off-bearing*," taking care of the bricks while drying, "*turning up*," and "*taking in;*" the machine doing all, between feeding the clay into it and "*hacking*" the bricks on the cars; the Dryer drying them, and the cars delivering them to the kilns.

Owning to our machine making the bricks stiff enough to be immediately "*hacked*" on to the drying cars, and not requiring them to be "*sun-dried*," we are enabled to *run all the year*, making our seasons from five to six months longer than those of the hand yards in this climate.

This alone is of considerable importance, and a great recommendation to Chambers' process.

Another and greater advantage is, that the manufacturing of bricks is conducted entirely under cover, the bricks at no time being exposed to the weather, drying under sheds if the Dryer is not used; consequently, we have no washed bricks, an advantage that builders are beginning to appreciate; neither do we lose any by being washed down by the rains.

This is an advantage that can not be appreciated except by those who have manufactured bricks in the old way, and have been obliged to get up at night, call their men, and go to the yard to take in bricks, or allow them to be washed and *pocket the loss.*

But if the hand-made bricks be not dry enough to "*hack*" when the rain does come, no matter whether day or night, Sunday or week-day, they *must be lost*, or at least damaged.

Brickmakers, by the old process, are like farmers with their hay or wheat out; while those who use our machine are like those who have their hay and sheaves nicely housed, always ready for a storm.

POWER REQUIRED TO RUN OUR MACHINE.

Many have been deceived in the size of engine required, and, disregarding our experience and recommendations, have put in too small engines, and been compelled afterwards to put in larger ones, thus losing much valuable time and money.

We always *try* to advise our patrons what we believe is *best for them*, and to our best judgment, regardless of our interest in the matter, believing that by so doing we will in the end secure their confidence and continued patronage.

DESCRIPTION OF CHAMBERS, BRO. & CO.'S ENGINE.

We have designed engines expressly for the brick machines, embodying all the improvements that sixteen years' study and experience in erecting and running them have suggested, and we know these engines possess many advantages over any other for the purposes for which they were designed.

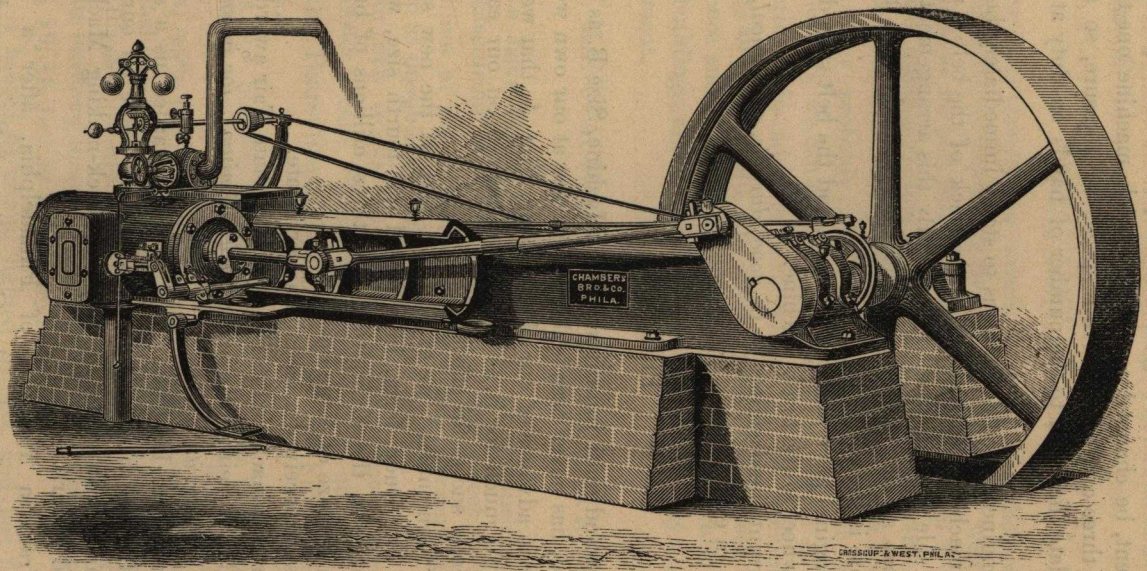
They are so arranged that any part of them is *easy of access*, both for cleaning and repairing. They are designed so as to be readily disconnected. The steam ports and valves are so arranged as to carry off the "condensed water" from the cylinder without bibcocks, consequently, a careless engineer can not knock off the cylinder heads. They have very large bearings, which make our engine wear much longer, and less liable to heat. The cylinders are jacketed, which keeps them warm, and prevents much condensation of steam. The piston-rods are of steel. The brasses are of the best metal, and everything is of the best quality.

They have a starting-bar, and treadle to unhook the valve-gear, so that the engine can be worked by hand and run in either direction.

They are equipped with coiled heater and duplicated stop-valves and drip-pipes, oil-cups, and everything for convenience, reliableness, and durability.

We build two sizes of these engines: one, especially designed for the old pattern brick machine, Size A, and is also used for Size B, where the clays are stubborn. It has a cylinder 15 inches in diameter by 36-inch stroke, and cuts off one-third stroke; or for those who prefer, we put on Trempler's governor, a variable cut-off, operated by the governor,—an admirable improvement.

For the new machine, Size B, in easy-working clays, we build an engine with cylinder 12 inches in diameter, by 27-inch stroke.



CHAMBERS, BRO. & CO.'S ENGINE—12-INCH BORE BY 27-INCH STROKE.

Recommended for their Brick Machine, Size B, in easy-working clays.

The governor is so arranged that the speed of the engine may, in a moment, be changed to run the brick machine one-third, one-half, three-quarters, or full speed, at pleasure, so as to accommodate the speed to the number of hands on duty at any time.

These engines are so designed as to stand immediately behind the brick machine, and run so that the slack of the belt is upon the upper side; an important feature. By this arrangement, the engineer has all the machinery under his eye, and much room and expense is saved.

These engines have pulley fly-wheels, and the belt runs direct from the wheel to the brick machine.

We warrant these engines to be *good, durable, economical,* and well fitted in every part.

PREMIUMS.

Our new and most improved Brick Machine, Size B, as now constructed, has never been exhibited except at our own works. It is so far in advance of our old machine, Size A, that we can not claim too much for it as an improvement upon our earlier and eminently successful efforts.

At the "Centennial" we exhibited a part of the new spiral cut-off in its crude form, in a model one-fourth size, which actually made in the Exhibition over three millions of bricks one-fourth the size of large ones.

For this we received a medal and certificate.

For our old machine the Pennsylvania State Fair awarded a silver medal, it being a "*discretionary premium*" *for ingenuity, usefulness, and merit.*

The American Institute, New York, awarded us a *silver medal* for the *best* bricks, which bricks were made on our old machine, and a *gold medal* for the *best* Brick-making Machine, Size A, old pattern.

The Franklin Institute, of Philadelphia, after a most thorough examination by the Committee of Science and the Arts, and three months' publication soliciting evidence of want

of novelty, awarded the Scott's Legacy *premium* and medal, for our new B Machine.

EQUIPMENT OF YARDS.

Parties contemplating embarking in the manufacture of bricks, or enlarging or improving their yards, would do well to confer with us, as we will make contracts to fully equip a yard with all the machinery that is necessary to manufacture a certain quantity of brick in a given time, and do it more economically than they probably would themselves. By our having the whole work we can give our customers the benefit of our large experience in adapting one portion of the machinery to the other, and supply all the conveniences that sixteen years' experience and observation have suggested, and furnish plans for the buildings, and locate same relative to the clay and point of shipment.

THE MANUFACTURE OF CHAMBERS' BRICK MACHINES AND DRYERS.

We have erected and fitted up an establishment for the manufacturing of these machines. Our object is to produce machines of the very best material and workmanship, and as cheap as possible compatible with the quality.

Our new works are situated at Fifty-Second Street, below Lancaster avenue, Philadelphia (near the Centennial Grounds), on the Pennsylvania Railroad, near the Fifty-Second Street Station.

As our business increased from time to time, we "moved west" for room, light, and air. We now have abundance of room, with new and well-planned buildings most admirably adapted to our business, which occupy nearly two hundred feet on Fifty-Second street, with three wings running back.

The finishing shop is 107 × 45 feet in the clear, three stories high, 19, 14, and 12 feet respectively.

It is heated by steam, lighted by gas, and has fire-pumps, pipes, and hose, wash-stands, &c., in each room, and is most admirably lighted and ventilated.

It is fitted with steam-hoist, crane, &c., and equipped with the most improved modern tools, many of them especially adapted to the manufacture of our brick machines and dryers.

Our foundry is 50 × 80 feet in the clear, one unobstructed room, admirably lighted on three sides, with steam heaters, gas, and water. It is equipped with crane, core-ovens, cupolas, &c., of ample capacity for making large loam or dry sand castings. It is fitted with steam-hoist for raising coal and iron to the cupolas, cleaning-house, pattern-room, &c., and is in every way well adapted for the production of first-class castings economically.

We claim that, with our present improved and well-lighted, warmed, and ventilated establishment and admirable tools, we can produce BETTER WORK AT LESS COST than heretofore, and hope to be able in the future to more promptly fill orders.

Our machines may be seen in operation by calling upon us at our works, when we will take pleasure in showing both our old and new machines, and at work practically during the brick-making season.

With each machine will be sent printed directions for its erection and operation, giving a complete list of all its numbered parts, with their use, weight, and cost of each.

For further information, machines, and rights, address

CHAMBERS, BROTHER & Co.,

Fifty-Second Street, below Lancaster Avenue, Philadelphia.

Or talk to us through Edison's Telephone Exchange, Southeast corner Third and Chestnut streets. Take local trains on Pennsylvania Railroad stopping at Fifty-Second street, or Arch, Race and Vine, or Chestnut street cars via Lancaster avenue.

CERTIFICATES.

We could add many certificates of the value and practicability of our brick-machines, and the quality of the bricks so made, but do not deem it necessary, after our offer to set up *machines subject to trial and approval* (see page 13). We annex a few, all from persons who have used or are now using our machines. Many of these are extracts from letters received by us in the regular course of business, and were written without any view to their being used in this way.

We attach a few, relative to the new pattern machine, Size B, to show how it is looked upon by those familiar with both.

The rest refer to our old pattern machine, Size A, some of which have been running seventeen years. (See certificate of Aug. Reeve, page 47.)

CERTIFICATES RELATIVE TO THE NEW CHAMBERS BRICK MACHINE, SIZE B.

"PHILADELPHIA, 2d Mo. 2d, 1878.

"I witnessed with great pleasure the operation of your improved brick machine, [Size B,] and have no hesitation in saying that I think it a great improvement upon the old machine. I used the old machine for some ten years, and hence may be entitled to an expression of an opinion as to their relative merits. The saving in fuel, and the more perfect arrangement for cutting off the bricks, are among the most prominent advantages of the new machine. The old machine was a good one, and I think the best that has been in operation in the city; and I am not sure that it was not, in the language casually used by a gentleman well acquainted with the brick business, 'the only one that ever paid the operator.'

"Very respectfully,

SIMON BARNARD.

"TO CHAMBERS, BRO. & CO."

FLORENCE, N. J., October 8th, 1878.

Messrs. Chambers, Bro. & Co.,

GENTS:—Your "B" brick machine continues to give good satisfaction. It is indeed a relief, after having tried another make *in vain*, to find yours will work our peculiar clay, and turn out so excellent a brick at the rate of thirty thousand per day. We will take great pleasure in showing any one due attention, that you may refer here to see it run.

Very truly Yours,

Florence Brick & Clay Co.,

JOSHUA EYRE,

President.

BRICK WORKS OF FLORENCE BRICK & CLAY CO.,

FLORENCE, N. J., January 20th, 1880.

Chambers, Bro. & Co.,

GENTLEMEN:—In answer to your inquiry concerning brick machine "B," I would state that it is a decided improvement over the old-style machine which I ran for a number of years.

The cutting arrangement works very satisfactorily, cutting the bricks all of uniform length, and making a perfectly smooth head.

The duster or sander is a good arrangement, sanding the bricks thoroughly on sides, top, and bottom. We have a bank of the hardest, most stubborn clay I ever saw, and have worked it in the machine for two years with much satisfaction. We made about 4,000,000 bricks last year, running only eight or nine hours per day, and making on an average 25,000. We could have made more, but did not have sufficient drying capacity. As an evidence of the superior quality of our bricks, we sold all we could make at fair prices. They were free from cracks and very strong, and gave satisfaction to those using them.

Yours respectfully,

JOHN W. AREGOOD,

Foreman.

"OFFICE OF FLORENCE BRICK AND CLAY COMPANY,
"514, 516, AND 518 BEACH STRRET,
"PHILADELPHIA, January 30th, 1880.

"*Messrs. Chambers, Bro. & Co.,*

"GENTLEMEN:—We have now been running your improved brick machine, with spiral cut-off, about two full years, and do not hesitate in saying it is the best brick machine for common building brick we know of. We made and sold four million bricks in the year 1879, and have many compliments from all our customers, that they are, without exception, the strongest and best bricks they ever used.

"Very respectfully, yours,
"Florence Brick and Clay Company,
"J. K. BOUGHER,
"*Superintendent.*"

(*No. 235.*)

INTERNATIONAL EXHIBITION.

PHILADELPHIA, 1876.

The United States Centennial Commission has examined the report of the Judges, and accepted the following reasons, and decreed an award in conformity therewith.

PHILADELPHIA, December 13th, 1876.

REPORT ON AWARDS.

Product.—Brick-making machine, operates by expressing the clay.

Name and Address of Exhibitor.—Chambers, Bro. & Co., Philadelphia, Pennsylvania.

The undersigned, having examined the product herein described, respectfully recommends the same to the United States Centennial Commission for Award, for the following reasons, viz.:—

For the strength and simplicity of its parts, the thoroughness with which it mixes and tempers the clay, the rapidity with which it produces good, common plastic bricks, and its low price.

Q. A. GILLMORE,
Signature of the Judge.

APPROVAL OF GROUP JUDGES.

E. P. COX,
HENRY WURTZ,
ARTHUR BECKWITH,
C. DE BUSSY,
DR. G. SEELHORST,
R. H. SODEN SMITH,
HECTOR TYNDALE.

A true copy of the record.

FRANCIS A. WALKER,
Chief of the Bureau of Awards.

Given by authority of the United States Centennial Commission.

A. T. GOSHORN,
Director-General.

[SEAL]

J. L. CAMPBELL,
Secretary.

J. R. HAWLEY,
President.

REPORT OF THE COMMITTEE ON SCIENCE AND THE ARTS.

No. 1014. HALL OF FRANKLIN INSTITUTE,

PHILADELPHIA, July 28th, 1876.

The Sub-Committee of the Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, to whom was referred for examination Chambers' Clay-Tempering Brick-making Machine, report that the machine has been in use about twelve years, being occasionally modified and improved as experience in working suggested. The last machines built and in actual use, are making bricks which bring better prices in the market than hand-made bricks, for certain purposes. The machine bricks can be dumped and handled with less waste, and will bear a greater pressure and harder usage. The objection to them is that their lengths vary slightly, and their ends are apt to be defective. A new cut-off has recently been devised, which we examined in operation on a one-quarter size model. Although this has not been applied to full size machines in actual work, yet we believe that it completely overcomes the difficulties, and will cut the bricks to uniform lengths, with clean, solid end and sharp edges.

The merit of the machine is its simplicity, there being no expensive details to require continual renewal. All the motions are rotary. There is an entire absence of links, joints, pistons, or nicely fitted surfaces to be worked in contact with the clay.

Everything seems calculated to produce the desired effect, by means suited to the nature of the material. The die, and cut-off knife, which are the only parts requiring occasional renewal, are cheap, and make a merely nominal item of expense.

The Brick Machine consists of a strong horizontal cylinder, which is cylindrical for a short distance and then tapering to the die-holder, which is held on its end by a hinge and hook bolt so as to be readily swung to one side. In the cylinder revolves a shaft having narrow knives projecting radially from it, and arranged spirally around it. On this same shaft, and in the small

end of the cylinder, is the pressing screw, which consists essentially of a cone, with a continuous spiral thread or blade wound around it, like the ordinary gimlet-pointed wood screw.

The clay is hauled from the bank, dumped on the receiving floor, and shoveled into the hopper of the machine without any previous treatment, except the addition of a little water. The hopper is circular, larger at the bottom than at the top, and enters the large end of the cylinder to one side of the centre line, so that the clay in falling meets the revolving knives as they are coming up. This keeps up an agitation of the clay in the hopper, and, together with the circular form, prevents any clogging or irregularity of supply. The knives break up the clay and thoroughly mix it into a homogeneous mass, and at the same time plow it forward to the pressing screw. This screw is smooth, while the chamber in which it revolves is fluted, so that the clay is treated like a nut, and forced forward, being at the same time compressed, owing to the gradually diminishing space. At the point of the screw the clay enters the die-holder, which is contracted at the sides to limit the amount, and enlarged at the corners to give an abundance, securing uniform density and sharp corners to the stream of clay issuing from the die. The die is made of chilled cast iron, and can be quickly replaced when worn. Its orifice is the shape of the end of a brick.

A curious effect of this pressure on the clay while it is in motion, is that the particles arrange themselves with the coarser ones in the centre of the stream, and the finer at the surface.

This was clearly shown by the fractures of burnt bricks. In the machines as heretofore built, the stream of clay was delivered on an endless belt and carried forward to the cutting-off wheel, which had a thin narrow blade of steel projecting from its circumference, arranged to cut off a brick length at every revolution of the wheel, the speed of the stream governing the speed of revolution. It was found, however, that the bricks would vary slightly in length; that the blow given by the blade would slightly depress the surfaces at the edges left by the cut; and that the ends of the bricks appeared cracked.

The new cut-off is designed to overcome these defects; and, as far as we can judge by the working of the model, its use will entirely prevent the variations in length of the bricks, and materially improve the appearance of their ends.

In this arrangement, the stream of clay is delivered on to an endless bed, made up of jointed plates, each the length of a brick, with narrow spaces between them to permit the passage of a continuous steel blade held spirally around a large cylinder. The projection of this blade from the cylinder gradually increases, and its pitch is the length of a brick; so that when the cylinder revolves, the blades will cut the stream of clay into lengths, which can not be greater than its pitch, and can be less only when the speed of revolution is too fast relatively with the speed of the stream. The coincidence of these speeds is successfully accomplished, in a very simple manner, by using the pressure of the stream against the blade as a means of governing the speed of revolution.

Simple and efficient arrangements are made to prevent any damage from the accidental presence of large stones in the clay.

After the bricks are cut off, they are traveled on an endless belt under a dusting machine, to put them in better condition for handling, and to improve the surface when burnt.

They are taken from this belt by hand, and passed through the usual process of hacking, drying, and burning.

Considering the difficulties encountered in attempting to work a material of the nature of clay, and looking at the simplicity of this machine, and its thorough adaptation to its purpose, and at the product which is being regularly and constantly obtained from it, at so little expense for renewals and repairs, we are of the opinion that it deserves very honorable notice by the Franklin Institute, and take pleasure in recommending the award of the Scott's Legacy Medal to Messrs. Chambers, Brother & Co., for the production of a commercially successful brick-making machine.

WILLIAM H. THORNE,
H. L. BUTLER,
CHARLES S. CLOSE,
THOMAS G. LOVEGROVE.

The above report was made prior to the embodiment of these recent improvements in our Size B machine, and this favorable opinion of these gentlemen, who are experts in machinery and building materials, gave us much encouragement to practically develop these new features.

Their judgment has since been verified by the actual practical working of full-sized machines.

William H. Thorne is a mechanical engineer, formerly of the firm of Thorne & De Haven, merchants, Philadelphia.

H. L. Butler is a mechanical engineer, formerly engaged in the machinery department of the Philadelphia City Water-Works.

Charles S. Close was a practical builder, VICE-PRESIDENT of the FRANKLIN INSTITUTE, and spoke not only as a member of the committee on "*Science and the Arts*," but from his knowledge after having *used millions of bricks* made on our old-pattern machine.

Thomas G. Lovegrove is a mechanical engineer, formerly boiler inspector of the city of Philadelphia, who has given much attention to arches, culverts, &c., and the strength of bricks.

"HALL OF THE FRANKLIN INSTITUTE,

"PHILADELPHIA, November 8th, 1876.

"Notice is hereby given that the Board of Managers of the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts have, in accordance with the recommendation of the Committee on Science and the Arts, awarded THE SCOTT LEGACY PREMIUM AND MEDAL to CHAMBERS, BRO. & Co., for their brick-making machine, and said premium and medal will be delivered to them, unless, within three months from this date, satisfactory evidence of the want of originality of said invention is lodged with the undersigned.

"D. SHEPHERD HOLMAN,
"*Actuary.*"

There being no evidence of the want of originality of our invention, the Scott Legacy Premium and Medal was delivered to us. This being a premium that has rarely been awarded, we are justly proud of it.

CHAMBERS, BRO. & Co.

CERTIFICATES RELATIVE TO THE OLD CHAMBERS BRICK MACHINE, SIZE A, AND THE BRICKS MADE BY IT.

"OFFICE OF PINE & MULFORD,
"BRICK MANUFACTURERS,
"CAMDEN, N. J., August 14th, 1876.

Messrs. Chambers, Bro. & Co., Philadelphia,

"GENTLEMEN:—In answer to your request for a statement of how our brick machine operates, we would state that this is the eighth season we have used your machine at Kinkora, N. J. The machine has given us general satisfaction. It makes a good, strong brick. We consider the improved screw a great improvement, making better bricks than the old pattern. Our machine-made bricks are much stronger, and occasion a great many less bats in the kiln, than those made by hand. We average over thirty thousand bricks per day.

"Our machine has not the 'new spiral cut-off.'

"Yours, &c.,
"CHARLES PINE & Co."

THE SOUTH STREET BRIDGE.

"* * * * The brick was specially procured from Pea Shore, New Jersey. They were made from pure blue clay, tempered and worked by the Chambers Brick-making Machine, and afterwards were subjected to a severe test, by building a wall three feet in height and thickness, and about ten feet in length, and laid in hydraulic cement. An experiment made after the wall was two weeks old, by breaking it with picks and

hammers, showed that the bricks and cement were so closely affiliated that they seemed to be one and the same substance. It had been alleged that machine-made bricks would not hold mortar. Their smoothness and want of porosity would not allow the holding of the cemented bond. The experiment, however, showed conclusively that they were eminently adapted for the purposes and use to which they were to be put.

"It is expected that this great work will be completed during the present year, and will be considered, when finished, the finest specimen of rectangular bridge engineering in the world."

[From the "Pennsylvania Engineer and Manufacturer," Francis D. Pastorius, Editor. For April, 1873.]

Since the above was put in type, the western approach to this bridge has fallen, owing to one of the piers settling into the marsh.

Upon examination of the ruins, the brick arches were found to be most thoroughly cemented, large masses, ten by twenty feet, remaining intact after falling some forty feet.

The bricks generally remained whole, with the mortar firmly adhering, thus giving every evidence of their having most thoroughly performed *their part* of holding up the great engineering work upon treacherous foundations.

C. B. & Co.

"Fairview Brick Works.

"Office: Foot of Kaighn's Point Avenue,

"Camden, N. J., July 18th, 1876.

"*Messrs. Chambers, Bro. & Co.*,

"Gentlemen:—In reply to yours of 17th, would say that we have had one of your machines in operation for the last six years, and that it has given entire satisfaction, with few exceptions. We make with our machine, at present, thirty-seven thousand bricks per day. We have made as high as fifty-five thousand in eleven hours, and could make without much trouble fifty thousand per day, at present, if necessary.

"Respectfully yours, &c.,

HATCH & BRO."

"JOHNSTOWN MANUFACTURING COMPANY,
"JOHNSTOWN, PA., July 20th, 1876.

"*Messrs. Chambers, Bro. & Co., Philada.,*

"GENTLEMEN:—The above company has been using the Chambers brick machine since 1864, with satisfactory results.

"Bricklayers, who were at first prejudiced against brick not moulded in sand, now prefer them above all others.

"Respectfully,
"JAMES ELDRIDGE,
"*Superintendent.*"

"OFFICE OF JOHNSTOWN MANUFACTURING COMPANY,
"JOHNSTOWN, PA.; August 16th, 1878.

"*Messrs. Chambers, Brother & Co.,*

"GENTLEMEN:— * * * * The bricklayers are very much pleased with the effect of our new duster on the brick—saying that they do not daub at all in laying.

"Respectfully,
"JAMES ELDRIDGE,
"*Superintendent.*"

"PEA SHORE STEAM AND HAND BRICK WORKS,
"OFFICE, 31 MARKET STREET,
"CAMDEN, N. J., July 24th, 1876.

"*Messrs. Chambers, Bro. & Co.,*

"GENTLEMEN:—Your favor of the 17th is at hand, requesting information in regard to your brick machine working at Pea Shore Brick Works. The machine now running was the first one erected, and prior to my taking possession of the works in 1866, was run very satisfactorily by Messrs. W. & M. Chambers; and since that time, now ten years, has not for breakage or repairs detained us as many days; in fact, feel the same confidence in its performing its work well and satisfactorily as we do in our steam-engine. The brick made are strong and durable, and give excellent satisfaction; we having been continuously busy is the

best proof of quality. Our product is from thirty thousand to forty thousand per day, and have made as high as fifty thousand per day of ten hours. The cost of repairs is but trifling, and confined to the natural wear of the machine.

"Yours respectfully,

"AUGUSTUS REEVE."

"WASHINGTON, D. C., July 27th, 1876.

"*Messrs. Chambers, Bro. & Co.,*

"GENTLEMEN:—We have been using two of your brick machines for six years, and during that period have had opportunities to see other prominent patents, and compare their merits. We would not exchange for any we have seen. For sewers and pavements, the bricks made by your machine are not approached, in the matter of strength and endurance, by any bricks, made by machinery or otherwise. They were tested in the Navy Yard in this city by pressure, and showed a power of resistance much beyond that of all other bricks subjected to the same test. Thanking you for prompt attention to orders, and uniformly courteous treatment, we remain,

"Yours, with respect,

"WINDSOR & FORD,
"FORD & BRO.,
"By J. H. FORD,
"*Attorney at Law, No. 435 Seventh Street,*
"*Washington, D. C.*"

"WASHINGTON, September 1st, 1874.

"*Messrs. Chambers, Bro. & Co.,*

"* * * * The new patent screw is making from thirty to thirty-five thousand bricks per day, out of new-dug clay, and with about two-thirds of the former consumption of coal. * * * *

"Very respectfully,

"WINDSOR & FORD."

FROM THE PHILADELPHIA LEDGER.

"To the Public.—* * * * We ask the attention of all who may need bricks, at present or in the future, to the following certificate, signed by a number of well-known builders, master bricklayers, and business men, who have used our bricks.

"We, the undersigned, having used large numbers of J. & T. Gillespie's machine-made bricks, know them to be strong, and suitable for any building requiring great strength.

"R. J. Dobbins, Ledger Building.

"Jacob Loeser, 1614 North Fifteenth street.

"E. Burroughs Warren, 2013 Spruce street.

"Warren, Kirk & Co., 228½ Walnut street.

"French, Richards & Co., York avenue and Callowhill street and Tenth and Market streets.

"Owen Morris, 1519 South Tenth street.

"John Campbell, 27 North Nineteenth street.

"Henon & Son, 1213 South Fifteenth street.

"James Watson & Co., 1119 Thurlow street, below Catharine.

"R. Quinton Gibbon, 319 South Eighteenth street.

"Hall & Garrison, 1126 Washington avenue."

* * * * * * * * * * *

"We use Chambers' Brick Machine and also make by hand. * * * * We send out bricks that are stronger and have less waste than any hand-made bricks in the city of Philadelphia. If you wish to purchase strong bricks, buy them of a man who has *good clay* and *uses Chambers' Machine.*"

* * * * * * * * * * *

"*Messrs. J. & T. Gillespie,*

Gentlemen:—In reply to your inquiries we would say that we have used large quantities of both machine and hand made bricks within the last eighteen years. In constructing our store at the north-west corner of Tenth and Market streets, we used

some 500,000 of your *machine*-made bricks with *far* less breakage and waste than in *any hand*-made bricks we have ever used. In working we found them to be exceedingly tough and hard.

"Yours, obedient,

"FRENCH, RICHARDS & CO."

"MESSRS. GILLESPIE:—Having been superintendent of the work and all the materials used in the erection of French, Richards & Co.'s building, at Tenth and Market streets, I will say that the 500,000 machine-made bricks sent by you were the best lot of bricks I ever used. There were not over two loads of waste in the whole, and were equal to any hand-made bricks in the city.

"THOMAS MARSH, Builder."

"*Messrs. J. & T. Gillespie,*

"GENTLEMEN:—I have used millions of your machine-made bricks, and I know them to be stronger, with far less waste, than hand-made bricks.

"Very truly yours,

"E. B. WARREN."

"MESSRS. GILLESPIE:—As I have bought large quantities of machine-made bricks of you, and as I have also used a great many hand-made bricks, I can say that for strength and freedom from waste your machine-made bricks stand A No. 1.

"OWEN MORRIS."

"*Messrs. Gillespie,*

"GENTLEMEN:—I have used one million and a half of your machine bricks, and I am satisfied that they are stronger, having less waste than any hand-made bricks.

"Yours,

"JACOB LOESER."

"MESSRS. J. & T. GILLESPIE:—We have used large quantities of bricks in our time, both of hand and machine made bricks, and can certify that your machine-made bricks are stronger and have less waste than any hand-made bricks we know of.

"JOHN HENON,
"DANIEL HENON."

We would call attention to the amount of *waste.* * * * It is *less than one five-hundredth of one per cent.* Therefore, all who wish to buy strong bricks, and who wish to avoid the expense of hauling rubbish away, *give us a call.*

Yours truly,

J. & T. GILLESPIE,
Philadelphia.

"PHILADELPHIA, January 28th, 1867.

"*Messrs. Chambers, Bro. & Co.,*

"GENTLEMEN:—We have used your machine-made bricks for pavements in our Galvanizing Works, where they become entirely *saturated with acid,* and exposed to hard usage, and they stand better, and last much longer, than any others we have ever used.

"MARSHALL, PHILLIPS & CO.,
"24 *Girard Avenue.*"

"OFFICE OF THE KEYSTONE SAW AND TOOL WORKS,
"67 AND 69 LAUREL STREET,
"PHILADELPHIA, January 28th, 1867.

"*Messrs. Chambers, Bro. & Co.,*

"GENTLEMEN:—I take great pleasure in stating that having had millions of bricks laid in my works, I must say that yours are the strongest of any others I ever tried, and the best, there being so much less waste.

"HENRY DISSTON."

"OFFICE OF THE CONTRACTOR OF CONNECTING RAILWAY,

"PHILADELPHIA, August 3d, 1866.

"*Messrs. Chambers, Bro. & Co.,*

"GENTLEMEN:—In the construction of my bridge work, on the Connecting Railway, I have used bricks made by your machine in turning arches, and find them to be of a very good quality. Where care is taken in the moulding and handling, the form of the bricks is more perfect than when made by hand; and as the pressure is greater in making, they are more compact, and will bear more weight. All the bricks required for my work, about 2,200,000, are made by your machines, and give entire satisfaction.

"Yours, very respectfully,

"THOMAS SEABROOK."

Fourteen years have elapsed, and we notice no sign of these bricks crushing or crumbling by the weather, except some soft burnt ones accidentally put on the outside.

CHAMBERS, BRO. & CO.

15-23-15.00